STATE OF THE ART IN THE MANAGEMENT OF THROUGH TRAFFIC IN RESIDENTIAL SUBDIVISIONS

by

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(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

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SUMMARY

Through traffic in residential subdivisions results from motorists seeking shortcuts between two arterial roads, or trying to avoid saturated intersections of two arterial roads.

Control techniques to reduce through traffic could be classified into internal, peripheral, or distributed within the residential areas. Internal traffic controls and controls to distribute traffic are provided along the through traffic streets and could be classed as (1) signs, (2) signals, (3) geometrics, and (4) pavement surface waviness. External traffic controls are applied at the periphery of the residenial area instead of inside it. The devices usually employed for peripheral control are signals, signs, or improvement in the geometry of the intersection.

The signs used for internal traffic control usually consist of 4-way or reversed stop signs, yield signs, 'No Trucks', 'One-Way', and 'Do Not Enter' signs. The effectiveness, advantages, and disadvantages of each sign are discussed in the report. Signals are expensive and their use is not recommended. Diverters, semi-diverters, 4-way stops, traffic circles, narrowing street width, one-way streets, and street closure are some of the geometric changes discussed. The disadvantages of bumps and dips and advantages of rumble strips are also given.

The need for community participation and enforcement in the implementation of controls is stressed.

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INTRODUCTION

The problem of through (commuter) traffic in the subdivisions of Fairfax County, a Virginia suburb of Metropolitan Washington, D. C., was referred to the Virginia Highway and Transportation Research Council by its Traffic Research Advisory Committee. The complaints made by the residents of the subdivisions cite objections to the volume of commuter traffic, through truck traffic, high speed by cummuters, and speeding by hot rodders. This problem is not peculiar to the suburbs of Washington, D. C., but also exists in urban and suburban neighborhoods of other metropolitan areas.

SCOPE AND PURPOSE OF THIS REPORT

The study of reducing through traffic in residential areas in Fairfax County has been divided into three parts as follows: Evaluation of 4-way and reversed stop signs; state of the art; and case studies. A report on the evaluation of 4-way stop signs has been submitted. This second report deals with the state of the art.

The purpose of this report is—

1. to give the state of the art of the techniques known to reduce through traffic or reduce the problems caused by through traffic in residential areas; and

2. to determine the most suitable techniques that could be adopted for application to the scattered problem of through traffic in residential subdivisions in Fairfax County.

REASONS FOR THROUGH TRAFFIC

Through traffic in residential subdivisions and its associated problems usually are attributable to:

1. Shortcuts between two arterial roads located on the periphery of a subdivision;
2. saturated intersections of two arterial roads;
3. overdesigned collector or subcollector streets; and
4. good street geometrics.

These causal factors are discussed below.

Shortcuts Between Two Arterial Roads

An arterial road is one which carries the traffic between the subdivision and the business district. It is not a residential street. Collector and subcollector streets are residential streets with residences along each side. In many cases a collector or a subcollector street or a combination of both connects two arterial roads. When the connection provides a shortcut between two arterial roads in terms of distance or time, commuters are tempted to use it.

Shortcuts depend upon the street pattern. Grid street patterns bounded by arterial streets could provide innumerable inlets and outlets for through traffic as shown in Figure 1.* A curvilinear street pattern with discontinous short streets and innumerable T-intersections discourage through traffic. However, a single weak spot in this curvilinear street pattern combined with the ingenuity of the motorist can lead to through traffic. A good example of such a curvilinear street pattern with one weak spot is the corner of Braddock Road (Route 620) and Rolling Road (Route 638) in Kings Park subdivision. The street pattern, through curvilinear, and with mostly discontinous streets and innumerable T-intersections, has a few continuous roads, one of which is South Hampton Drive (Route 3647), which connects the two arterial roads. This road is reported to be carrying through traffic to the dissatisfaction of residents. Commuters use South Hampton Drive to shorten their travel time and distance. The street pattern of this subdivision and its boundary arterial roads are shown in Figure 2. A summary of the preliminary traffic survey of the area is given in Appendix 1.

*All figures are attached.

The results of the preliminary survey in Appendix 1 show that unless proved otherwise, for a wide 2-lane road a peak hour traffic of 350 vehicles per clock hour (in both directions) could be considered the maximum permissible limit for a comfortable level of traffic without complaints from the residents. Montgomery County, Maryland, engineers consider 200 vph (in one direction) to be an excessive volume.(1) They are of the opinion that this volume appears to coincide with the approximate point when local residents experience a measure of visual and mental disturbance, thereby causing them to initiate complaints of excessive traffic.

Saturated Intersection of Two Arterial Roads

Sometimes an intersection of two arterial roads becomes oversaturated and the service level of the intersection deteriorates. Commuters try to avoid such intersections, and if a suitable route through adjacent residential areas exists they certainly make use of it. By so doing the commuter may not save distance but he certainly saves time. A good example of such a saturated intersection in Fairfax County is the intersection of Telegraph Road (Route 611) and N. Kings Highway (Route 241). The saturated condition there has resulted in heavy amounts of through traffic on Farmington Drive (Route 1616), a very narrow residential street in Jefferson Manor Park. The street pattern of this subdivision and its bounded arterial roads are shown in Figure 3.

Overdesigned Subcollector or Collector Streets

The usual capacities of subcollector and collector streets as recommended by the top organizations in the country are 200 to 1,000 and 800 to 3,000 vpd, respectively.(2) If in planning or expanding a subdivision this factor is overlooked, the result is innumerable complaints of heavy traffic by the local residents. A good example of this condition is Huntsman Blvd.(Route 4521) in Orange Hunt Estate in Fairfax County. On this 0.67 mile long collector street, the traffic recorded in an April-November 1975 survey was 9,662 and 5,572 vpd at its two extremities. This boulevard is the only link between arterial Route 644 and the residences in the subdivision. The street plan for Orange Hunt Estate is shown in Figure 4.

Street Geometrics

Good street geometrics such as wide streets and flat horizontal and vertical curves with good sight distances encourage speed and attract through traffic, while narrow streets with poor geometrics have opposite effects. To eliminate or reduce through traffic in residential areas, the degree of discouragement on the through residential streets should outweigh the disadvantages on the arterial streets in terms of distance and time. A good example of this approach is Chesterbrook Road (Route 689), a residential street in Chesterbrook subdivision. This road connects Kirby Road (Route 695) in Fairfax County and Glebe Road (Route 120) in Arlington County. It carries through traffic and at the request of the local residents is confined to two lanes. Techniques for changing geometrics to discourage through traffic are described in the next section of this report.

SUBDIVISION TRAFFIC MANAGEMENT SYSTEM

The problem facing Virginia suburbs of Washington, D. C. is isolated and localized in subdivisions of 200 to 1,000 one- or two-family residences. Traffic management in these isolated subdivisions could be obtained by techniques for (1) internal traffic control, (2) peripheral traffic control, and (3) distributing traffic in residential streets.

The techniques for internal traffic control and for distributing traffic in residential streets are provided along the through traffic streets. The techniques for the peripheral system are provided outside the residential neighborhood at or near the access to or exit from the street having through traffic. Techniques for the distribution of traffic in residential streets are recommended if internal or peripheral control techniques are not found suitable or economical. The three types of techniques are discussed below.

Techniques for Internal Traffic Control

The following techniques for internal traffic control to slow traffic or divert it away from residential areas have been tried all over the country. These techniques could be divided into four classifications as follows: (1) Signs, (2) signals, (3) geometrics, and (4) pavement surface waviness. Techniques under each classification are described in the following subsections.

Signs

Signs are the cheapest of all devices and are subject to easy alterations. Signs used in this country are described below.

Stop Signs– Appleyard[3] reports that in San Francisco a survey disclosed that the most common traffic deterrent desired by the residents was the erection of stop signs. Two systems of stop sign installations have been used by governmental agencies. One system is the 4-way stop sign and the other system is the reversal of the stop signs from the minor street to the through traffic street. Both systems are shown in Figure 5.

In Virginia, in addition to the use of the MUTCD warranted 4-way stop signs, the author is aware of a number of locations in residential subdivisions where the reversed stop sign technique has been used to the satisfaction of the residents.

A national survey was conducted by the author by means of questionnaires on both systems of stop signs and the results, given in a separate document,[4] may be summarized as follows:

1. The use of the 4-way stop signs is very popular with most residents.

2. Unwarranted MUTCD 4-way stop signs are not recommended my most government agencies.

3. In some states the laws permit litigation against the state or other government agency by the road user for the recovery of damages suffered. In such states there is a great need for strict adherence to the MUTCD warrants or some sort of modified warrants with good legal support.

4. Four-way stop signs are necessary where the view of the crossing traffic is obstructed.

5. Stop signs are ineffective as speed deterrents except in the immediate vicinity of the control device.

6. Very few agencies have used reversed stop signs and many of those who have used them have converted to 4-way stop signs.

Whenever 4-way stop sign systems are provided, it is desirable to provide two stop signs for each way. Large (36 inches or more), reflectorized stop signs would not likely be overlooked by drivers. However, experience should indicate the type and size needed.

Yield Signs- The author knows about only one county, Oakland County, Michigan, which has used yield signs to reduce through traffic and speeding. Under their system, traffic entering a subdivision on the major road yields to the traffic on the minor road. At succeeding intersections the yield signs are alternated between the minor and major roads. The county managing director claims that under this system accidents have been few and damage has been minor.

MUTCD warrants are less strict for yield signs as compared to stop signs, when such signs are placed to control the major flow of traffic at an intersection. The provision of yield signs instead of reversed stop signs across the major roads may prove to be more beneficial because of the following two reasons:

1. The disobedience and disrespect held for 4-way and 2-way stop signs, as reported by some agencies, are avoided. This is because yield signs do not require a complete stop and it is not then necessary to assign the right-of-way to the traffic on the crossing street.

2. Stop signs provide a false sense of security to pedestrians. The technique of an alternate system of yield signs as tried by Oakland County, Michigan, could therefore be tried on an experimental basis in Virginia.

Speed Limit Signs—In Fairfax County, many times the subdivision residents complain about high speed-35 mph to 50 mph- by the commuters using their streets. They have requested that the posted speed limit be changed to 25 mph. In response to the requests, speed studies have been carried out with the higher speed limit posted. An example is Olley Lane, where the posted speed limit is 40 mph. The results of this study showed that the 85th percentile speed was 42 mph. One may argue that the results of such studies are biased and that if the posted speed was 25 mph, the 85th percentile speeds obtained would be lower. This argument is supported by the fact that the 85th percentile speed on interstate highways decreased when the posted limit was lowered to 55 mph. Table 1 shows the effects of reductions in speed limits on 85th percentile speeds. This table shows that when the speed limit was 70 mph the 85th percentile speed was 73.2 mph; when the speed limit was 65 mph the 85th percentile speed was 70.6 mph; and when the speed limit was 55 mph the 85th percentile speed was 64.4.mph. Thus, we find that as the speed limit was decreased from 70 to 55 mph the difference between the speed limit and 85th percentile increased from 3.2 to 9.4 mph. It is therefore likely that when the speed limit is still further decreased, say to 25 mph, the 85th percentile speed would be much higher than the speed limit. It is therefore concluded that reducing the posted speed limit may be ineffective in reducing speed.

Table 1

Posted Speed Limits and 85th Percentile Speeds for Cars

Posted Speed Limit – MPH	85th Percentile, MPH	Year	Route
70	74	1973	I-64 (Goochland Co.)
	70	1973	I-64 (Alleghany Co.)
	72	1973	I-66 (Fairfax Co.)
	72	1973	I-77 (Wythe Co.)
	75	1973	I-85 (Dinwiddie Co.)
	76	1973	I-95 (Spotsylvania Co.)
	73.2 Avg.		
65	70	1972	I-64 (Goochland Co.)
	68	1972	I-64 (Alleghany Co.)
	70	1972	I-66 (Fairfax Co.)
	74	1972	I-85 (Dinwiddie Co.)
	71	1972	I-95 (Spotsylvania Co.)
	70.6 Avg.		
55	64	1974	I-64 (Goochland Co.)
	60	1974	I-64 (Alleghany Co.)
	64	1974	I-66 (Fairfax Co.)
	63	1974	I-77 (Wythe Co.)
	67	1974	I-85 (Dinwiddie Co.)
	66	1974	I-95 (Spotsylvania Co.)
	61	1976	I-64 (Goochland Co.)
	66	1976	I-77 (Wythe Co.)
	67	1976	I-85 (Dinwiddie Co.)
	66	1976	I-95 (Spotsylvania Co.)
	64.4 Avg.		

Other Types of Signs—In addition to stop signs, yield signs and speed limit signs, the other types of signs that could be used to reduce complaints are described below.

1. "No Trucks" Sign. Truck traffic is a principal source of complaints. When an alternate route for trucks has been determined, a "No Trucks" sign is installed at the entrance to the road that previously has carried through truck traffic. After the posting of this sign, complaints stop. This system is used in Virginia.

2. "One-Way" and "Do Not Enter" Signs. Converting existing gridiron systems to curvilinear and discontinuous street systems. By means of "One-Way" and "Do Not Enter" signs (separate or in combination with diverters or semi-diverters) a curvilinear and discontinuous system with short streets and T-streets could be developed in residential areas. This change in systems could be used to divert or distribute the through traffic within a residential subdivision. Montgomery County, Maryland, has used this system in a subdivision near a commercial center and thus has reduced the maximum hourly volume to less than 150 vehicles on all streets in that subdivision.(1)

Signals

The best example of a popular use of traffic signals for reducing through traffic known to the author is in the city of Philadelphia where over the five-year period 1964-68 an average of two intersections per week were signalized. Ebbecke reports that the citizens banded together to block public throughfares to secure traffic signal control of a particular intersection.(5) Later the remedy chosen was 4-way stop signs, which proved most effective in curtailing new signal installations by 65%. Within 130 square miles of Philadelphia, in an area with two million people, there are now 3,300 signalized intersections and about 1,850 4-way stop signs. The 4-way stop signs are nearly all in residential areas with very few being in business areas.

Except for Philadelphia, the author is not aware of any places where light signals have been frequently used to discourage through traffic. The reason for their not being used is probably their high cost.

Activated Flash Speed Warning

The activated flash speed warning device is, as its name implies, a device activated by speeding vehicles that warns the motorists that they are in violation of the speed limit. The provision of this device in residential areas is economically unfeasible, and the author knows of no agency which has used the warning signal in such areas.

Geometrics

As noted before, a slight error in the planning of a neighborhood street system coupled with ingenuity of the driver could lead to through traffic. Such traffic could be discouraged by changing the geometry of the street although people used to the old geometrics might not like the change. Diverters, semi-diverters, 4-way stars, traffic circles, narrowed street widths, one-way streets, and street closures are some of the geometric changes used. They are described below.

Diverters— Three types of diverters— the diagonal, star, and island types shown in Figure 6— have been used or recommended by certain agencies. The diagonal and star types divert traffic on both crossing streets. Island diverters prevent through traffic on one of the crossing streets. Other designs include solid diverters to divert all traffic, and diverters with undercarriage barriers to prevent cars but allow school buses, fire trucks, etc., to pass, and diverters with movable gates or flexible stanchions for emergency vehicles only.(6) The diversion of traffic is very distasteful even to the residents of the neighborhood. Diverting traffic may cause legal implications. Diverters therefore are not recommended for use in Fairfax County— where the through traffic problem is scattered and isolated— except under special circumstances and at the request of a great majority of the local and neighboring residents.

Semi-Diverters— Semi-diverters divert traffic in one direction on a street by either blocking entry and permitting exit or blocking exit and permitting entry. Both systems are shown in Figure 7. Semi-diverter installation on existing streets may require the movement of storm drains. Semi-diverters would permit traffic in one direction. However, when used in combination with other impediments they could stop through traffic without obstructing traffic movement inside the neighborhood. A good example of the use of a semi-diverter is the installation across service roads on Route 50 near Brook Drive in Fairfax County. It has been accepted by the residents because it does not interfere with the free flow of travel by local residents.

The use of some of the semi-diferters is shown in Figure 7. Such diverters have been used in many street management plans. The best recent example of use is in the Berkeley traffic management plan of 1975. This plan provided for the closing of two major streets and the installation of 46 traffic diferters, 10 traffic signals, 17 traffic circles, and 300 stop signs.(3) Most of the proposed stop signs have not been installed and the diverters are so numerous that Berkeley is now called the city of diverters. A report on the six-month experience with the installations shows that there is considerable failure to obey all types of traffic management devices.(7) Time will prove the success or failure of the plan. Semi-diverters are not recommended for use in Virginia unless requested by a majority vote of the local and neighboring residents.

Four-Way Star— A four-way star, as shown in Figure 8, reduces the distance between sidewalks and makes street crossings safer. Its use is therefore limited to promoting pedestrian safety.

Traffic Circle— Traffic circles have a potential for reducing the volume and speed of traffic in an area. Sinemus reports that in Berkeley this concept has been very well received by neighborhood residents as it permits access to all legs of the street where a diverter forces people to drive around the block.(8) Sinemus further reports that the traffic circle has been very effective as a self-enforcing speed reducer which has relieved some pressure on local police departments. Violations of traffic circles (left turns on wrong side of circle) are also reported.(7) Traffic circles reduce the width of the traffic lane but enough opening need be provided for large vehicles using the street. Traffic circles may help in reducing vehicular and pedestrian accidents. A typical traffic circle is shown in Figure 9.

This device seems to have a lot of potential and should be evaluated for increased use. It does not seem to be expensive and its cost might compare favorably with that of 4-way stop signs if cheaply planned. Proper design to prohibit left turns on the wrong side is essential.

Narrowing Street Width— Narrowing or necking of the street is achieved by widening the sidewalks. Chokers(8), as shown in Figure 10, reduce the pavement width by increasing the width of the sidewalk near the intersection. They improve visibility by preventing parking at the intersection and reduce speed at the intersection by reducing the width of the traffic lane. They channel traffic away from the sidewalk and reduce pedestrian accidents. This device could be helpful near schools on streets with parking. Installation would require moving the storm drains. Chokers could be provided at the middle of the

lane, if needed, by widening the sidewalks or by providing a landscaped median as shown in Figure 10. These devices for narrowing street widths could be expensive but are very practical.

Street Closure— Other techniques for eliminating through traffic are to provide a cul-de-sac or to close the street as shown in Figure 11. Complete restraints or too severe restrictions on traffic such as these seem to be unacceptable to the public and are met with severe objections. They may lead to legal action, so should be avoided if possible.

Pavement Surface Waviness

Pavements should be smooth for a comfortable ride. Surface waviness causes a very uncomfortable ride and, depending on its type, may be dangerous. To create discomfort and reduce speeds two types of waviness have been used; namely, rumble strips and bumps or dips.

Rumble Strips— Rumble strips have been tried with success for reducing speed. They cause a very undesirable noise and a rough ride. Kurt Franke showed that with 1/4-in. (6.35 mm) high strips placed at 10 ft. (3.05 m) intervals, the noise and vibrations increased as speed increased.(9) A rumble strip pattern is shown in Figure 12. This device has been tried and has been recommended for reducing speed. It may also be successful in preventing speeding by hot rodders, but would need further investigation for this purpose. The spacing, number, thickness, and durability of the strips may need further tests.

Bumps or Dips— A bump is much larger in cross section then a rumble strip and is placed at much greater intervals. A dip is a depression in the pavement. Some are shown in Figure 12. Bumps have been effectively used on private streets in apartment and condominium areas but are considered dangerous by some experts. C. D. Allen and L. B. Walsh in their recent study have shown that bumps could prove dangerous and may lead to legal implications.(10) Until some suitable design is developed, their use is not recommended.

Techniques for Peripheral Traffic Controls

Techniques for controlling through traffic may be applied at the periphery instead of inside the residential area. These techniques are useful in highly trafficked commerical areas which border residential subdivisions. Montgomery County, Maryland, officials have recommended that consideration be given to providing these control techniques when the following four conditions are satisfied.(1)

1. Short-cutting is being experienced through the residential areas.

2. The peak hour traffic in one direction on a residential street is 200 vph or more.

3. The service level of the adjacent intersection as obtained by the "Critical Movement Summation" method of capacity analysis[11] will not deteriorate beyond level D, or where the existing E or F level of service will not be extended.

4. There is written concurrence of a majority of the affected residents of the subdivision.

After a number of court battles, blocking of the street and continued resident and user complaints over several years, a problem on Brooke Drive in Fairfax County was resolved by installing a peripheral control system using light signals and signs. The traffic was reduced from 2,450 vpd in 1969 to 1,273 vpd in 1975. The peak hour traffic on April 22, 1975, on Brooke Drive was 73 vehicles, which is much below the complaint level.

The devices that could usually be employed for peripheral control are light signals or signs. Sometimes the intersection geometry may need to be altered by means of islands or widening of pavement markings to improve the service level. Peak hour traffic control could be obtained by use of signs such as the following.

1. No right turn signs
   7-9 A.M. or 4-6 P.M. (variable)
   Monday-Friday (variable)
   Except buses (variable)

2. No left turn signs
   7-9 A.M. or 4-6 P.M. (variable)
   Monday-Friday (variable)

Techniques for Distributing Traffic in Residential Areas

The internal traffic management techniques described above could be used to reduce the load of through traffic on one street and to divert traffic onto other streets to keep the traffic volume on any street at an acceptable level. As discussed before, for a wide road a peak hour traffic of 350 vehicles per hour in both directions would be an excessive volume. This volume may coincide with the approximate point when local residents experience a measure of visual and mental disturbance, thereby causing them

to initiate complaints. Until data are available that indicate otherwise, Fairfax County could adopt this standard and use techniques for distributing traffic when this limit is exceeded. The most economical technique for distributing traffic could be by the use of signs. Use of one-way or do not enter signs for this purpose may be very efficient, but would be much resented. Milder impediments would be the use of stop signs or yield signs or traffic circles or rumble strips on through traffic streets.

IMPLEMENTATION OF THE MANAGEMENT PLAN

Successful implementation of the management plan is the most difficult part of responding to residents' complaints over through traffic. For successful implementation the following procedures are suggested.

A. A preliminary survey— A preliminary survey must be made to determine the cause of through traffic and provide data for determining the magnitude of the problem. One preliminary report of a survey of a through traffic street is given in Appendix 1.

B. Determination of the most suitable systems of techniques within permissible economic limits to eliminate the problem— This determination could be made from preliminary surveys or a more detailed survey.

C. Community participation— Community participation is the most important element for successful implementation of the plan. A committee made up of residents should be responsible for analyzing the problem through consultation with the city, county, or highway department. A clear majority support of the plan in the community in writing is essential before implementation. The commitment from the community should be at least for a period of one year to determine the effectiveness of the plan. An initial period of three to six months is considered to be needed for adjustment of the people to the changes implemented by the plan. In some cases it may be necessary to get the approval of people of the adjacent neighborhood who would be directly affected by the plan. All people affected should be informed to prevent frustration by the user after the plan is initiated. The changes made should be advertised and posted at the entrance of the neighborhood to prevent frustration to commuters.

D. Enforcement– Statutory law enforcement by the police department is necessary.

E. MUTCD Warrants– All systems and devices used should be in accordance with the MUTCD to prevent legal action by road users.

F. Special Ordinances– Ordinances can be enacted whereby the federal MUTCD warrants for 4-way stop signs for highways and streets may be relaxed for application to residential streets. The relaxation of warrants should be based on sound traffic engineering principles with no public or political pressure.

CONCLUSIONS

1. Four-way stop signs, even though unwarranted by the MUTCD, are very popular with residents. State and local government agencies do not favor use of stop signs not warranted by the MUTCD.

   Agencies may seek local ordinances for relaxing MUTCD warrants to permit warrants on residential streets. The ordinances should be based on sound engineering principles to avoid litigation.

2. Very few agencies have used reversed stop signs, and many of those who have used them have changed to 4-way stop signs.

3. Traffic circles and scanty use of stop signs and yield signs may prove to be economical and successful in preventing through traffic.

4. Traffic circles, rumble strips, and narrowed street widths may reduce speeding.

5. Reductions in posted speed limits may not help in reducing actual speeds.

6. The following traffic volumes could be considered tentative limits for justifying citizen complaints about through traffic. (1) 350 vehicles per peak hour in both directions for wide 2-lane streets with parking lanes almost empty, or (2) 200 vph in one direction.

6. Peripheral controls could prove to be effective and their application extended.

7. Community participation is absolutely necessary for successful implementation of a traffic management system. Written approval by the majority of the residents for a one-year implementation is essential.

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Appendix A

PRELIMINARY SURVEY OF SOUTH HAMPTON DRIVE(3657)

THROUGH TRAFFIC STREET

LOCATION —South Hampton Drive in Kings Park Estate, Fairfax County, Virginia.

SERVICE —(a) Collector street for Kings Park Estate residents.

(b) Services about 700 residents of the Estate (mostly single family residents) and one elementary school.

COMPLAINT —Through traffic.

LIVABILITY —Kings Park is a mostly single family residential area with middle-class home owners. All residences along South Hampton Drive are single family units with driveways.

DESCRIPTION & GEOMETRY —(a) Two lanes with two parking lanes and two sidewalks, Parking lanes not much in use, which gives a feeling of a 4-lane road.

(b) Bar of an A with two arterial roads, Braddock Road(620) and Rolling Road(638), as legs.

(c) Rolling and curvilinear.

(d) Length 1.2 miles.

SIGNS, SIGNALS, & PAVEMENT MARKINGS —(a) Posted speed 25 mph.

(b) One school-pedestrian crossing flashing sign.

(c) After citizens' complaints, reversed stop signs provided at two intersections.

(d) Intersection with arterial roads is signalized. It is partly a facility and partly an impediment.

TRAFFIC —April-November report gives the following traffic count:

(a) 6,801 vpd on South Hampton Drive near Braddock Road.

(b) 6,161 vpd on South Hampton Drive near Rolling Road.

(c) 4,602 vpd is the minimum traffic on South Hampton Drive.

(d) Morning peak hour traffic on March 25, 1976, was 276 vehicles in one direction and 372 in both directions.

ARTERIAL ROAD

DESCRITPION & GEOMETRY —(a) Braddock Road(620) is 4-lane divided.

(b) Rolling Road(638) is partly divided and partly undivided.

(c) Their total length between two ends of South Hampton Drive is 1.9 miles.

SIGNS & SIGNALS —(a) Posted speed limits are 40 and 45 mph.

(b) Three light signals- visual inspection at approximately peak hours indicates a satisfactory level of service (say D) on Rolling Road and less satisfactory level of service (say between E and F) on Braddock Road(620). This approximate evaluation of levels could be erroneous.

TRAFFIC —The April-November report gives the following traffic counts:

(a) 26,170 to 33,048 on Braddock Road(620).

(b) 12,810 to 13,965 on Rolling Road(638).

PRELIMINARY SURVEY REPORT

A. Travel distance saved is 1.9 - 1.2 = 0.7 mile.

B. Travel time saved during peak traffic hour is approximately 5 minutes.

C. Estimated traffic generated by the subdivision at the rate of 10 trips per residence is 700 x 10* = 7,000 vpd. The traffic entering or leaving the subdivision is 6,161 + 6,801 = 12,961 vpd. Hence there is evidence that about 12,961 - 7,000 = 5,961 vpd are due to through traffic. This figure may be on the high side.

D. At peak hour 276 vehicles in one direction and 372 vehicles in both directions may be noted as comfortable levels of traffic without complaints from the residents.

CONCLUSIONS AND SUGGESTED REMEDIES, IF ANY

Other than peak hour traffic count, no detailed investigation is necessary.

A. The impact of the light signal at the junction of Braddock Road and South Hampton Drive on the through traffic could be investigated.

B. There is a national trend in changing from reversed stop signs to 4-way stop signs. Since residents desire to have 4-way stop signs instead of reversed stop signs, their request could be reconsidered.

C. There is evidence of through traffic in spite of the provision of reversed stop sign systems at two locations. As the traffic on the arterial road increases, the through traffic on South Hampton Drive will also increase. Additional traffic management plans like the addition of 4-way stop signs may be necessary. The effectiveness of traffic circles could be tested on this street, since the street is wide enough to accommodate them.

D. At peak hours 350 vehicles in both directions could be tentatively considered as a peak of the comfortable level of traffic on a wide road without complaints about through traffic from the residents.

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*Pages 1 and 2 of "Method of Determining Traffic Usage of Revised Subdivision Standards" as conveyed by a memorandum dated October 3, 1968, from the deputy commissioner and chief engineer to the boards of supervisors of all counties in the secondary system, suggest the rate of traffic generated by each dwelling unit is equal to 7 vehicles. However, in the investigation 10 instead of 7 vehicles are being taken.

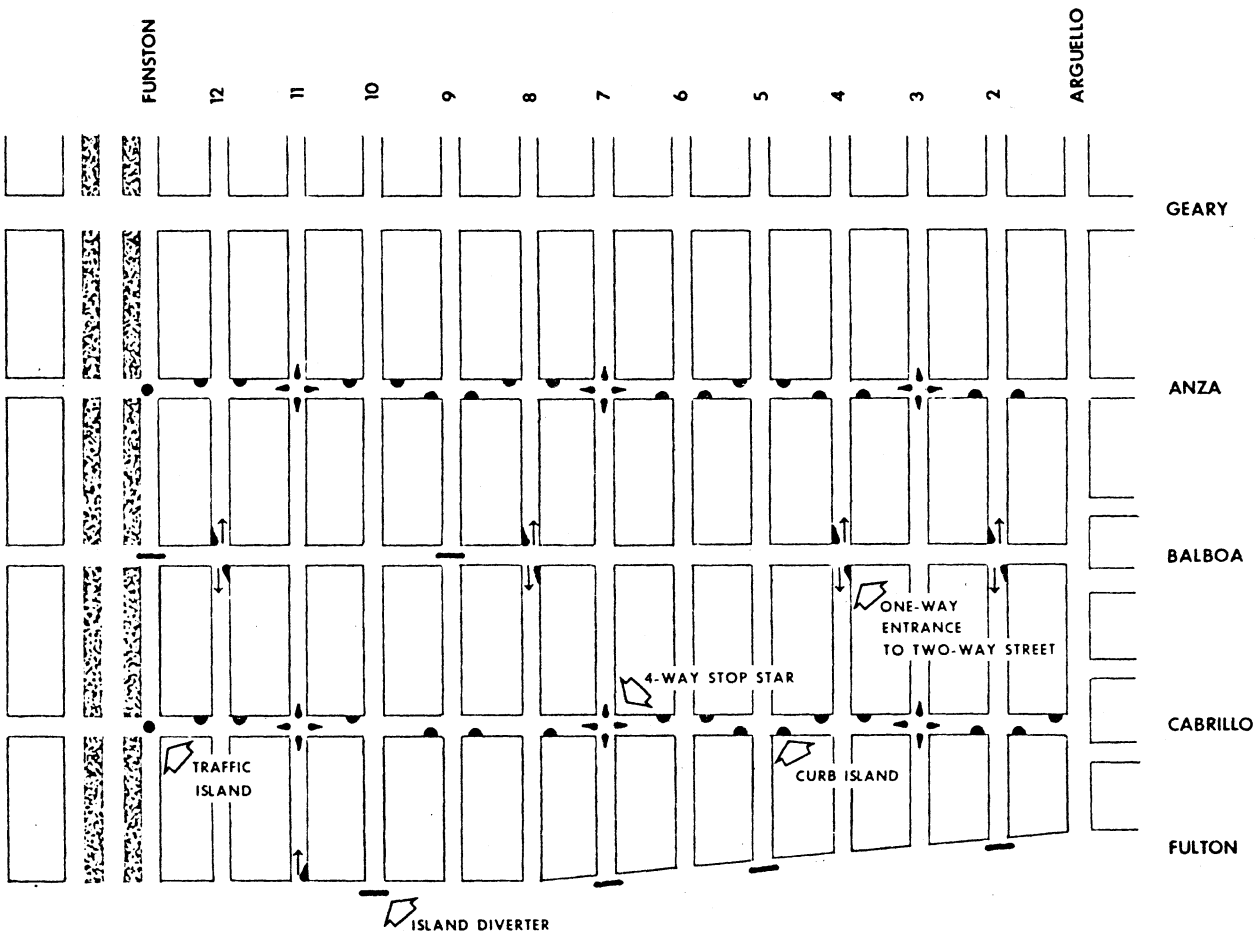

Figure 1. Grid street pattern with internal traffic management techniques. (Courtsey: San Francisco. Proposal for Inner Richmond)

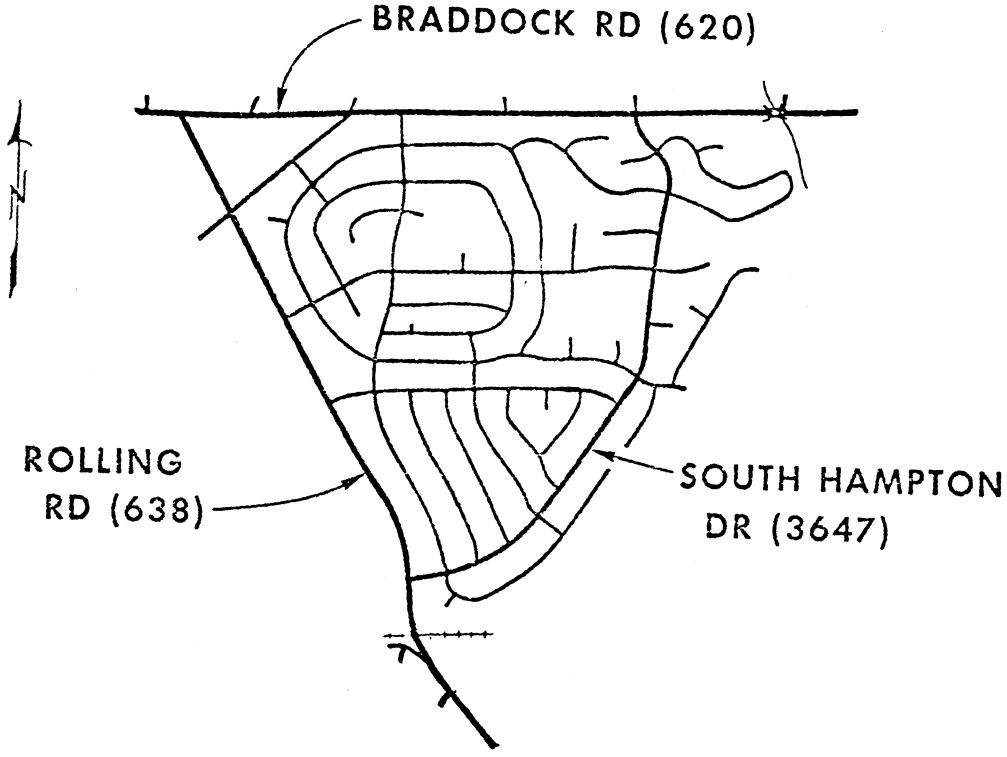

Figure 2. Residential subdivision at the corner of Routes 620 and 638 with Route 3647 having through traffic.

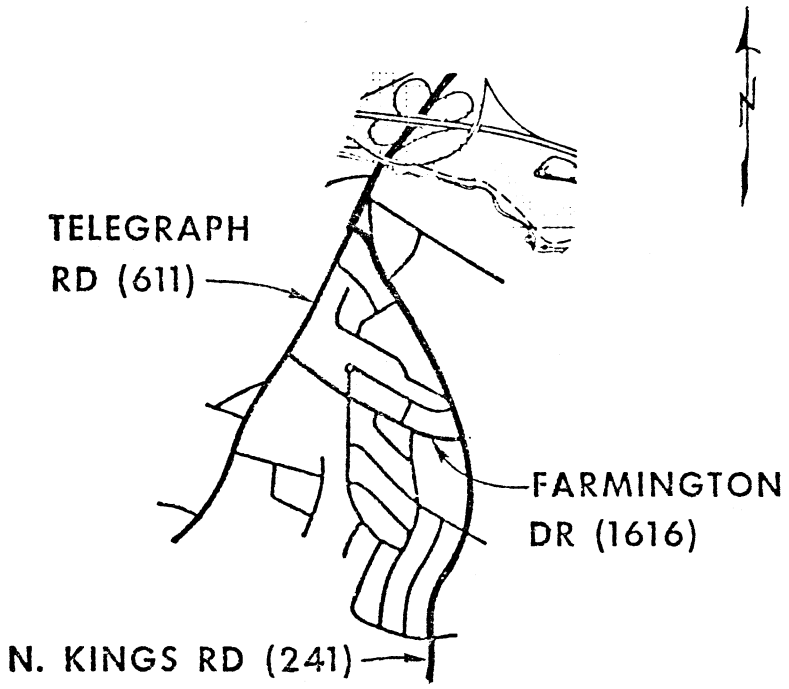

Figure 3. Residential subdivision at the corner of Routes 611 and 241 with Route 1616 having through traffic.

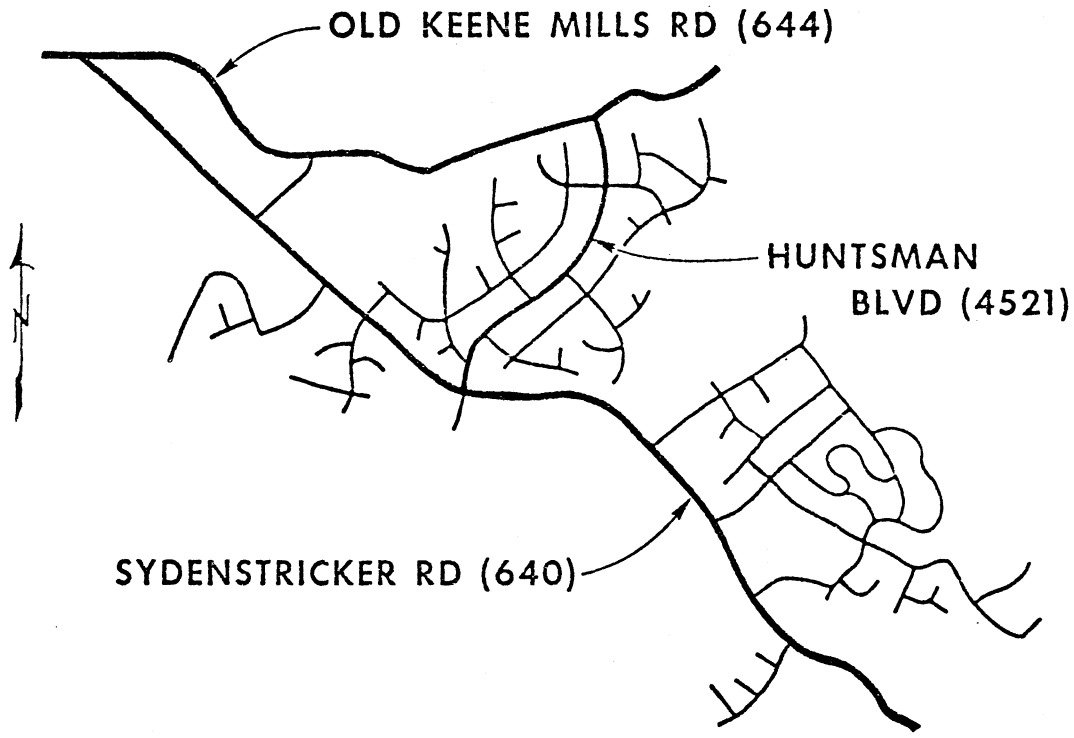

Figure 4. Residential subdivision (Orange Hunt Estate) with an overly designed residential street (Route 4521).

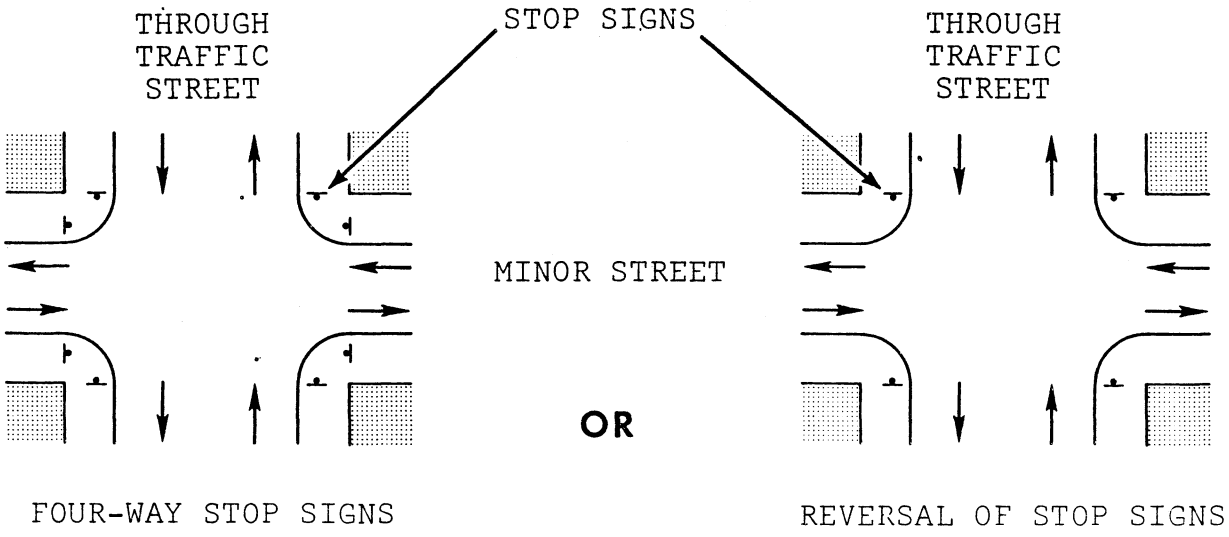

Figure 5. Stop signs are used extensively. Cheapest of all devices. Very popular among residents. Generally do not satisfy MUTCD warrants and hence are unpopular with governmental agencies. May reduce accidents and may not reduce traffic speed.

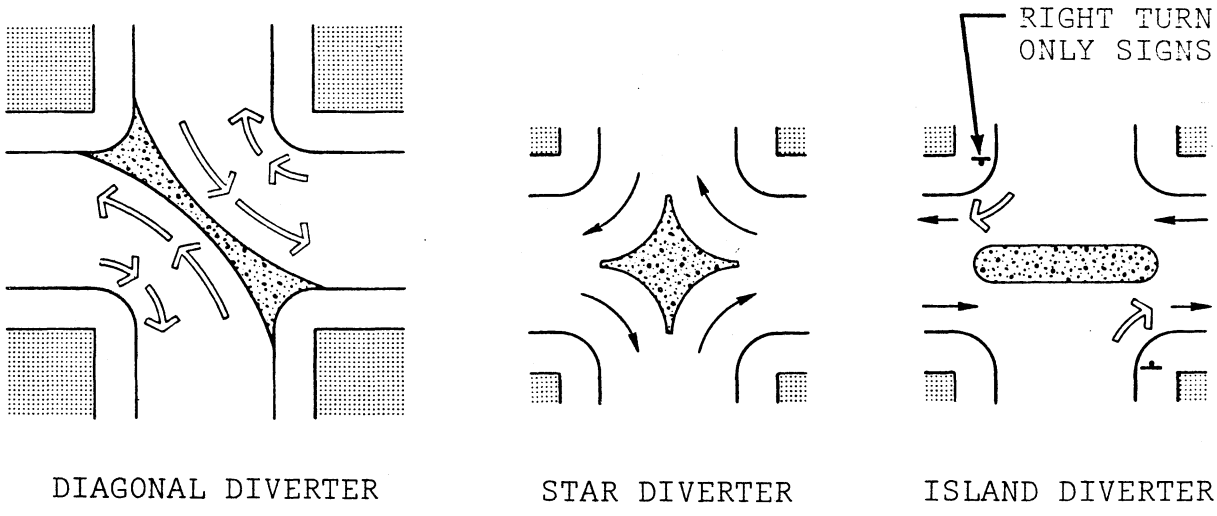

Figure 6. Diagonal diverters and star diverters divert traffic on both the crossing streets. Island diverters prevent through traffic on one of the streets.

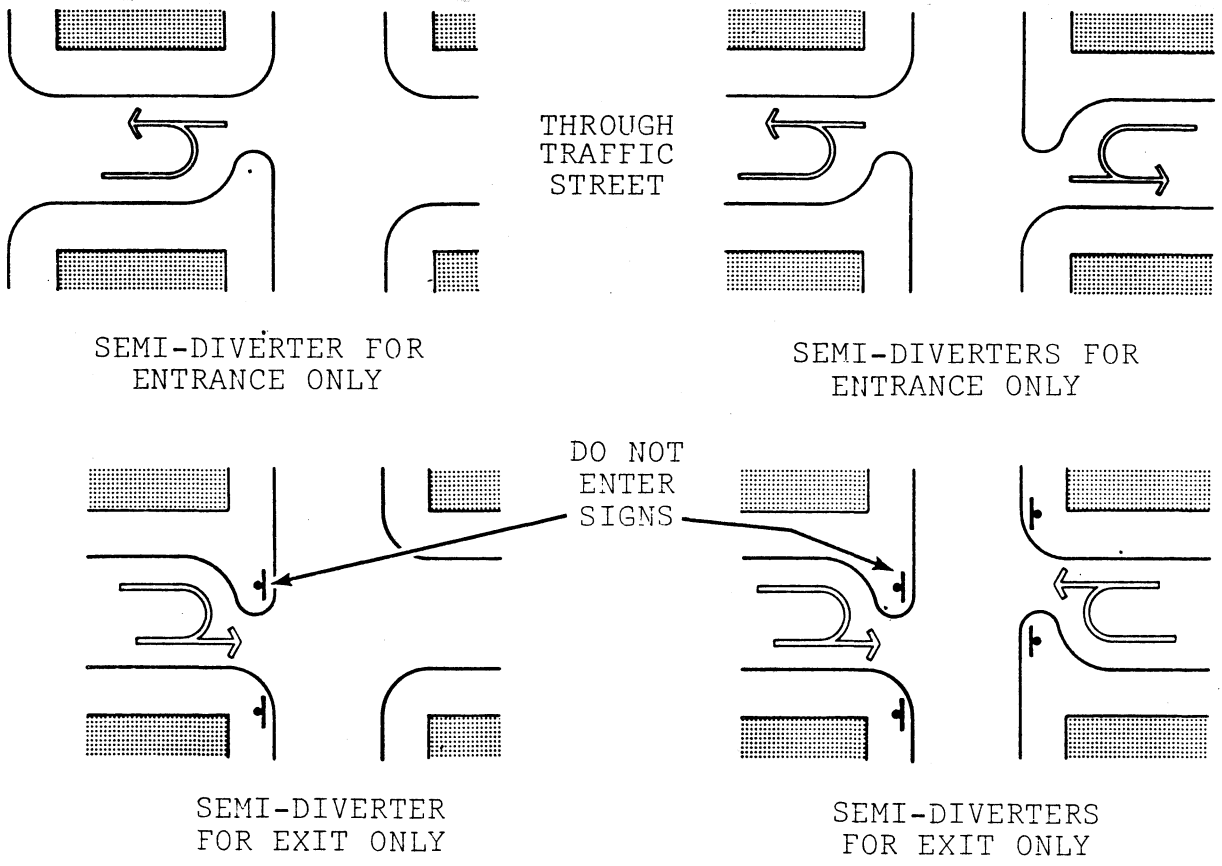

Figure 7. Semi-diverters divert one direction of traffic by either blocking entry and permitting exit or blocking exit and permitting entry.

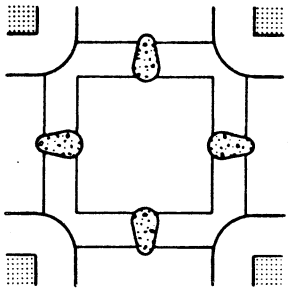

Figure 8. Four-way star reduces distance between sidewalks and makes street crossing safer.

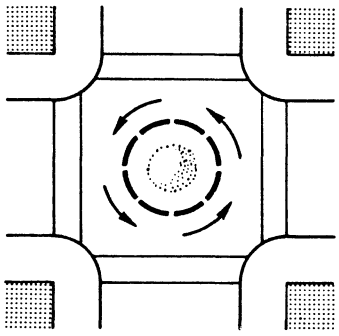

Figure 9. Traffic circle reduces volume and speed of through traffic and brings traffic nearer to the sidewalk.

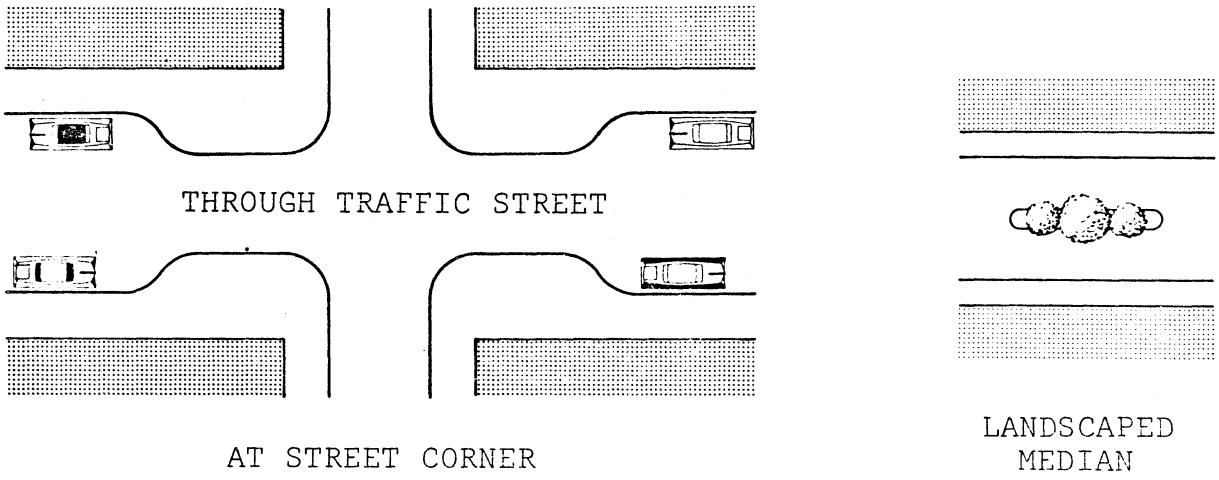

Figure 10. Chokers improve visibility by prohibiting parking at the intersection and also may reduce speed. They channel traffic away from the sidewalk. Landscaped chokers discourage speed and provide greenery.

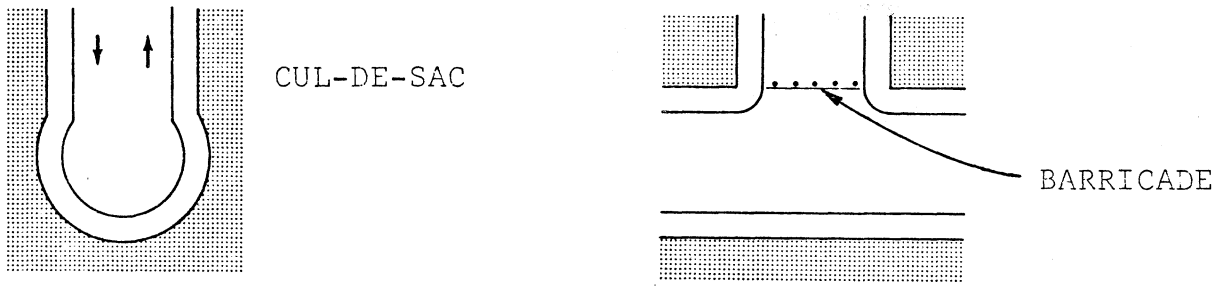

Figure 11. Street closures— unpopular among residents.

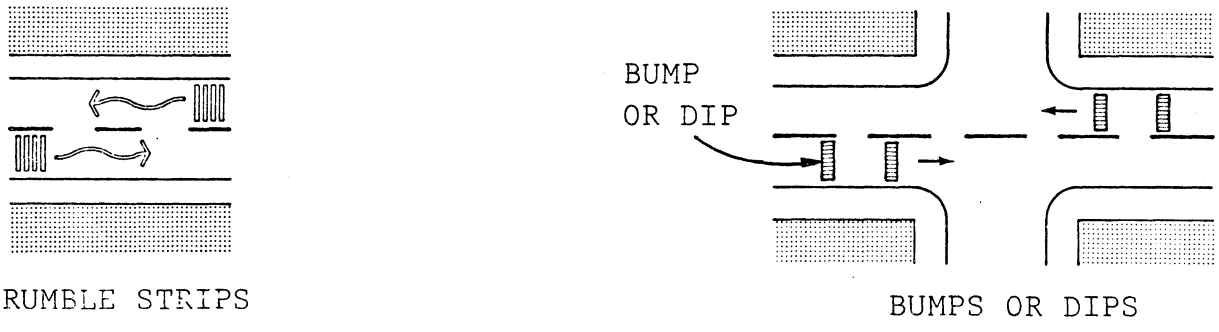

Figure 12. Pavement surface waviness. Rumble strips cause noise and roughness at high speeds. Bumps and dips discourage speed but could be dangerous.